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modern designers is the thermal properties of materials. These properties have little value for a designer unless they are given as functions of temperature, since they vary with temperature by the factor 2 or more. Even for the most common materials, we do not have these data at the temperatures used in modern engineering. Reflectivity should be added to the usual list of thermal properties since its effect on the heating rate may be as high as 20 per cent.

More detailed data may often change the decision of a designer from a strong material to a weaker one. For instance, if one of two materials is weaker but the test data show smaller scatter, the designer may decide in favor of the weaker material, use a smaller factor of safety and thus not only reduce the weight but have the advantage of greater ductility. Certainly, to achieve this he needs statistical data. When using cold-worked austenitic stainless steels for webs and struts in compression, we may gain weight by employing half-hard material instead of stronger full-hard material, because the half-hard material is straighter and will, therefore, resist buckling conditions better. We may select softer and weaker material for a part made by cold working operations and obtain a stronger part than by using the same material in a stronger state. But to do it intelligently we need strain-hardening data—that is, true stress-strain curves.

When designing a pressure vessel, we may again find that the material with the highest tensile strength does not always produce the strongest vessel, if the reserve of ductility of this material is not sufficient to prevent the embrittling effect of combined tensile stresses.

If we draw in the same coordinates stress-strain curves for two different materials, we may find that they intersect. This will indicate that one material is preferable for low stresses, while the other is preferable for high stresses. Similarly, we may find that materials which are stronger at room temperature are not necessarily stronger at elevated temperatures.

All this indicates that the usual data on properties of materials are not sufficient for designing with confidence light, strong and reliable structures.

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